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Information asymmetry and financial development dynamics in Africa

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Abstract

We examine policy thresholds of information sharing for financial development in 53 African countries for the period 2004–2011. Public credit registries (PCRs) and private credit bureaus (PCBs) are used as proxies for reducing information asymmetry whereas financial development includes all financial dimensions identified by the financial development and structure database (FDSD) of the World Bank, namely: depth, efficiency, activity and size. The empirical evidence is based on interactive generalised methods of moments with forward orthogonal deviations. The following findings are established. First, PCRs and PCBs have negative effects on financial depth, with the magnitude of the former higher. Second, contrary to PCRs which have insignificant effects, PCBs have a negative impact on banking system efficiency. Third, PCRs and PCBs have negative impacts on financial activity, with the magnitude of the latter higher. Moreover, both of their marginal effects are negative. Fourth, PCRs and PCBs have positive effects on financial size, with the effect of the former higher. While marginal effects are positive, corresponding thresholds are not within range. Policy implications are discussed.

JEL classification: G20; G29; O16; O55

Keywords: Information asymmetry; Financial development; Africa

1. Introduction

The World Bank publication of April 2015 on world development indicators has revealed that poverty has been decreasing in all continents of the world with the exception of Africa (Asongu & Kodila-Tedika, 2015). According to the report, many countries in the continent are failing to attain the millennium development goals (MDGs) extreme poverty target (Caulderwood, 2015; World Bank, 2015) despite over two decades of growth resurgence that began in the mid-1990s (Fosu, 2015, p. 44).

There is a wide consensus from recent literature that the quality of growth needed to reduce poverty is positively driven by financial development (Asongu, 2015; Asongu & De Moor, 2015). Unfortunately, access to finance in African financial institutions has been marred by substantial issues of surplus liquidity (Saxegaard, 2006; Fouda, 2009), despite the introduction of public credit registries (PCRs) and private credit bureaus (PCBs) to mitigate the information asymmetry associated with financial development (Triki & Gajigo, 2014). The underlying measures towards reducing information asymmetry have fundamentally been linked to the imperative of increasing information-sharing among banks in order to reduce adverse selection and moral hazard between lenders and borrowers. This is supported by a large number of literature documenting that basic financial access in Africa (like credit, payments, private and corporate insurance) has been substantially constrained by a plethora of factors that limit, inter alia: eligibility, physical access and affordability (Batuo & Kupukile, 2010; Allen et al., 2011).

There has been a considerable amount of theoretical studies supporting the position that information asymmetry hereafter IA between lenders and borrowers affects financial development by reducing the efficient allocation of capital (Jappelli &

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Pagano, 2002). In essence, lenders are most often confronted with issues of adverse selection owing to their lack of information on the characteristics of borrowers, especially when it comes to risks associated with the investment for which borrowers want to mobilise financial resources. In addition, the concern is even more worrisome when lenders are unable to control the actions of borrowers after credit has been granted. Accordingly, a borrower could decide to conceal the proceeds of the underlying investment in order to reduce responsibility in event of default or prevent repayment of the underlying debt. Such tendencies are not exclusively present in insolvent borrowers since solvent borrowers could also face the temptation of manoeuvring to avoid complying with reimbursing financial obligations associated with the loan. Ultimately, in order for lenders to caution against such risks, credits are often characterised with rationing activity and high interest rates which have substantial adverse consequences for financial development, growth and poverty alleviation. These downsides can be limited by the sharing of information on borrowers' solvency characteristics. PCBs and PCRs serve as brokers for this by providing the much needed information to banks. Consistent with Jappelli and Pagano (2002), by sharing information these brokers enable, among others: the efficient allocation of capital, relaxation of credit constraints and increase of credit market competition.

In the light of the above, there has been a substantial body of the literature devoted to assessing (i) the role of IA among creditors and (ii) the effect of stronger rights to information by creditors. The former (i) has examined how the sharing of information improves credit availability (Djankov et al., 2007; Brown et al., 2009; Triki & Gajigo, 2014), reduces credit costs (Brown et al., 2009), decreases rates of default (Jappelli & Pagano, 2002), affects corruption-related lending (Barth et al., 2009), influences antitrust intervention (Coccorese, 2012) and affects syndicated bank loans (Ivashina, 2009; Tanjung et al., 2010). The latter (ii) has assessed the role of stronger creditor rights in, among others: capital structure, risk-taking by banks (Houston et al., 2010; Acharya et al., 2011) and bankruptcy (Claessens & Klapper, 2005; Djankov et al., 2007; Brockman & Unlu, 2009).

What is quite apparent in the above literature is the overwhelming focus on regions where concerns about financial access are relatively less severe. In essence, whereas the great bulk of the literature has been devoted to developed countries and the emerging economies of Asia and Latin America, very little scholarly focus have been oriented towards Africa, a continent with the lowest level of financial development (Galindo and Miller, 2001; Love and Mylenko, 2003; Barth et al., 2009; Triki & Gajigo, 2014).

Galindo and Miller (2001) have provided macroeconomic evidence to establish that countries with more advanced development in credit registries are rewarded with less financial restrictions relative to those with credit bureaus that are less developed. Particularly, credit registries that are performing well, account for substantial decreases in a firm's sensitivity in investment decisions to 'cash flows availability', a typical proxy in the literature for financial constraints. As for Latin American countries, the authors conclude that there has been a reduction in the performance of credit registries by about 50 percent of how investment decisions are sensitive to internal funds. Love and Mylenko (2003) have combined firm-level data from the World Bank Business Environment Survey (WBES) with data on public and private credit registries to assess if: (i) from the perception of managers and (ii) higher sharing of financing from the bank, the existence of credit registries is negatively associated with credit financing constraints. Findings reveal that the presence of private registries are linked to higher shares of bank financing and lower financing constraints, whereas the presence of public registries do not appear to exert any significant impact on underlying financing constraints. Barth et al. (2009) investigate the impact of lender and borrower competition as well as the sharing of information through credit registries/bureaus on corruption in lending by banks using the WBES covering 4000 firms across 56 countries and private credit in 129 countries. Two main findings are established. First, both information sharing and banking competition mitigate 'lending corruption' and the sharing of information plays a positive role in influencing competition to curtail corruption in lending. Second, it is also found that the legal environment, firm competition and ownership structure of banks and firms, have significant effects on lending corruption. Triki and Gajigo (2014) have examined: (i) the impact of private and public credit registries on access to finance by firms and (ii) the effect of PCR's design on the seriousness of financing constraints, in 42 African countries. Their findings show that (i) access to finance is on average higher in countries with PCBs, relative to those with PCRs or neither institution and (ii) there is substantial heterogeneity in financial access and design of information-sharing institutions among countries with PCRs.

The above studies leave room for improvement in three main areas: sampling, data and methodology. First, very few lines of inquiry have been positioned on Africa, in spite of the continent having the most acute financial access problems. Consistent with this idea, Love and Mylenko (2003) and Barth et al. (2009) have positioned their inquiries on four and nine African countries respectively. Whereas Galindo and Miller (2001) involve no African country, Triki and Gajigo (2014) which is closest to the present study have based their analysis on 42 African countries for the period 2006–2009. We fill underlying gaps by working on 53 African countries for the period 2004–2011.

Second, the discussed literature above, as well as recent information sharing (Houston et al., 2010) and IA (Ivashina, 2009; Tanjung et al., 2010) literature has been limited to bank specific measurement of constraints to financial access. We steer clear of this literature by using all financial dimensions identified by the financial development and structure database (FDSD) of the World Bank. These scopes include financial dynamics of depth (overall economic depth and financial system depth), efficiency (at banking and financial systems levels), financial activity (from banking and financial system perspectives) and size. The plethora of dimensions has been documented to provide more complete policy implications (Asongu, 2014). In essence, the fundamental objective of increasing (reducing) information sharing (information asymmetry) is to improve financial intermediation efficiency and the sharing of information to boost

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competition and reduce information rents which could lead to more lending or financial activity (Pagano & Jappelli, 1993, p. 2019). Increasing financial activity and financial allocation efficiency logically implies increasing financial depth and size within an economy.

Third, the bulk of the literature has consistently failed to present findings that are robust to endogeneity. Ivashina (2009, p. 301) cautioned that the proper examination of IA in the banking industry should account for endogeneity, in order to avoid biased estimations and misplaced policy implications. For instance whereas Jappelli and Pagano (2002) have used Ordinary Least Squares while controlling for potential unobserved cross-country heterogeneity, Triki and Gajigo (2014) do not go further towards tackling inherent issues of simultaneity between information sharing offices (ISOs)[1] and the banking industry: "*Our results show that firms in countries with PCBs report relatively smaller obstacle in access to finance relative to those in countries with PCRs. However, this effect is not robust to controlling for GDP per capita and the private credit to GDP ratio, which suggests that the presence of a PCB is not exogenous. In other words, the level of financial sector development and the creation of a PCB may be simultaneously determined.*" (p. 75).

As highlighted above, it is important to recall that the positioning of this inquiry on Africa is due to scarce literature on the subject on the continent, in spite of (i) recommendations for a more scholarly focus on the underlying issues (Singh et al., 2009, p. 13) and (ii) growing concerns about whether African financial institutions are tailoring information from ISOs to improve their returns instead of increasing financial allocation efficiency and activity (Triki & Gajigo, 2014). In essence, the nature of the connection between information sharing and bank lending remains an open debate in theoretical and empirical literature (Jappelli & Pagano, 2002).[2]

The rest of the study is organised as follows. The background and theoretical underpinnings are presented in Section 2. Section 3 discusses the data and methodology. The empirical analysis, discussion of results and implications are covered in Section 4. Section 5 concludes with future research directions.

2. Background and theoretical underpinnings

ISOs which are also known as 'credit reference agencies' are institutions that collect information related to the obligations of individuals and commercial borrowers from many sources: public sources and direct investigation (for businesses), banks and credit card companies (for individuals) and retail lenders. The collected information is then consolidated after cross-checking for a comprehensive report. Once the report is established, it can be used by future creditors. The data from the reports on credit history is usually information of negative and positive nature, notably (i) positive information (entailing details on all open and closed amounts as well as on repayment behaviour) and (ii) negative information (consisting of mostly information on default rates).

ISOs are essential for the provision of credit essential for the prosperity of an economy because they enable the mitigating of information asymmetries that limit the ability of lenders to exhaustively assess the risk profiles of borrowers. On the one hand, data from credit histories enable the address of adverse selection that is apparent from creditors because they facilitate the obtaining of reputational collaterals by creditors, especially in scenarios where exhaustive information is needed. On the other hand, ISOs reduce moral hazard by tackling the concerns surrounding the unappealing behaviour from borrowers on the repayment of their debts, thereby, strengthening default and repayment rates. The ensuing increase in lending is crucial to the sectors with substantial financial constraints such as micro, small and medium enterprises.

In accordance with Mylenko (2008), prior to 2008, ISOs were for the most part restricted to a few countries in the Organisation for Economic Cooperation and Development and Latin America. After 2008, the burgeoning of information and communication technologies has substantially favoured the establishment of ISOs in Sub-Saharan Africa, Eastern Europe and the Middle East and North Africa. Therefore, by 2008, with the exception of South Africa, few countries had ISOs in the Sub-Saharan Africa region. Some nations like Mozambique, Rwanda and Nigeria had also instituted credit registries with the core aim of strengthening banking sector supervision. Unfortunately, given the lack of proper technology and incentives, timely and accurate information was not often provided by these credit registries. However, with the growth of information and communication technology, several initiatives on introducing ISOs were taken across the continent.

Consistent with Claus and Grimes (2003) and Asongu et al. (2016), there are two main theoretical underpinnings on the relationship between information sharing and financial access. The first articulates the transformation of bank asset risk characteristics while the second is focused on the channels through which liquidity from banks can be increased. Furthermore, the two strands of the literature are consistent with the view that the fundamental role of a bank is to fulfil its financial intermediation role of transforming mobilised deposits into credit for economic operators.

The connection between ISOs and financial access can be understood from two perspectives, namely adverse selection from lenders and moral hazard from borrowers. ISOs avail lenders with information and credit histories on borrowers which enable them to reduce high interest rates that are motivated by adverse selection. When borrowers have been granted a loan, they become liable to moral hazard given that they can avoid the repayment of their financial obligations towards the bank by concealing economic activities upon which the loan was granted. It is therefore the role of ISOs to discipline borrowers on the negative consequences of non-compliance. Many times, ISOs educate borrowers on the inconveniences of debt default and

[1] For the purpose of simplicity, we used ISOs to denote both PCRs(PCR) and PCBs(PCB).

[2] "*On the whole, all three models agree on the prediction that information sharing (in one form or another) reduces default rates, whereas the prediction concerning its effect on lending is less clear-cut*" (Jappelli & Pagano, 2002, p. 2020). As we shall see in Section 3.1, the corresponding lending dimension is expressed by the financial dynamics of allocation efficiency and activity.

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perils of seeking refuge in the informal financial sector as a sustainable alternative to the formal financial sector (Tchamyou & Asongu, 2016).

3. Data and methodology

3.1. Data

We examine a panel of 53 African countries with data for the period 2004–2011 from the African Development Indicators (ADI) and the financial development and structure database (FDSD) of the World Bank. Data on public credit registries and private credit bureaus is only available from 2004 and the last year in the financial development and structure database is 2011. We acknowledge the fact that GDP figures may be unreliable in some African countries. However, to the best of our knowledge the World Bank is one of the most reliable sources of data. Consistent with the motivation of the study, baseline financial development indicators are transformed in accordance with Asongu (2013, 2014) to obtain dynamics of depth, efficiency, activity and size.

First, two indicators of financial depth entail: (i) overall-economic depth (*M2/GDP*) representing the monetary base plus demand, saving and time deposits and (ii) financial system deposits (*Fdgdp*) in terms of liquid liabilities. We distinguish the former from the latter because; a substantial portion of the monetary base in less developed countries does not go via formal financial institutions. Second, by financial intermediation efficiency, we refer to the ability of banks to fulfil their fundamental role of transforming mobilised deposits into credit. Two measurements are used, namely: (i) banking-system-efficiency (with 'bank credit on bank deposits: *Bcbd*') and (ii) financial-system-efficiency (with 'financial system credit on financial system deposits: *Fcfd*'). Third, by financial intermediary activity, we denote the bank's ability to grant credit to economic agents. Two proxies are also employed, namely (i) banking system activity (with 'private domestic credit by deposit banks: *Pcrb*') and (ii) financial system activity (with 'private credit by domestic banks and other financial institutions: *Pcrbof*'). Fourth, financial size is the ratio of 'deposit bank assets' to 'total assets' ('deposit bank assets on central bank assets plus deposit bank assets': *Dbacba*).

Consistent with Triki and Gajigo (2014), we measure information asymmetry with public credit registries (PCRs) and private credit bureaus (PCBs). In accordance with the underlying literature, there are six principal distinguishing features between PCRs and PCBs: access, data sources used, ownership, status, coverage and purpose. First, access to PCBs (PCRs) is open to all types of lenders (restricted to information providers). Second, data used by PCRs is obtained from bank and non-bank financial institutions whereas PCBs includes: PCRs, courts, tax authorities and utilities to the sources used by PCRs, for information. Third, as concerns ownership, PCRs belong to central banks or governments, while the ownership of PCBs extends beyond the underlying institutions (governments or central banks) to lenders, independent third parties and lenders' associations. Fourth, while PCRs are not profit-making registries, PCBs are principally established for profit. Fifth, whereas coverage provided by PCRs is principally on large corporations and restricted in terms of history and type of data (or information) provided, PCBs extend well beyond large corporations, to small and medium size enterprises (SMEs), which have longer histories and richer data. Fifth, while PCRs represent public institutions that are established with the main mission of supervising the banking sector, PCBs are created because of demand for, and need of information on borrowers in the banking market. Therefore, data from PCRs used to assess clients' credit-worthiness could also be considered as some form of by-product or collateral benefit of PCRs.

The control variables include: inflation, public investment, GDP growth, trade and foreign aid. These control indicators have been substantially documented in the financial development literature (Osabuohien and Efobi, 2013; Huang, 2005; Asongu, 2014). First, some major national macroeconomic policies such as the maintaining of lower inflation and higher investment have been established to be favourable to financial development (Huybens and Smith, 1999; Boyd et al., 2001; Huang, 2011). Huybens and Smith (1999) and Boyd et al. (2001) have theoretically and empirically investigated the impact of inflation on financial development and concluded that economies with higher inflation rates are likely to be rewarded with smaller, less efficient and less active banks. Second, the nexus between investment and financial development has been assessed by Huang (2011) who has found a positive relationship. Third, some studies support the perspective that policies which are favourable to openness in terms of external trade are positively associated with higher levels of financial development (Do & Levchenko, 2004; Huang & Temple, 2005). Fourth, a plethora of papers have established the positive link between growth and finance (Greenwood and Jovanovic, 1990; Saint Paul, 1992; Asongu, 2015). According to the narrative, economic prosperity in terms of economic growth is associated with a decreasing cost of financial intermediation owing to intensive competition, involving a substantial scale of funds made available for productive investments. Moreover, the importance of income-levels in financial development has been extensively documented in the literature (Levine, 1997; Asongu, 2012). For instance (i) Jaffee and Levonian (2001) have shown that income levels have a positive impact on banking system structure and (ii) Asongu (2012) has concluded that African countries with higher income levels are associated with better financial development. Fifth, analogous to remittances (Aggarwal et al., 2011; Efobi et al., 2014), foreign aid that is spent in recipient countries and not captured by consultancy services in advanced nations is more likely to boost financial development. It should be noted that expected signs of the control variables cannot be definitely established because the financial variables present contrasting dynamics. For example financial efficiency is, in broad terms, the ratio of financial depth to financial activity (deposits/credit).

The definition and sources of the variables are provided in Appendix A, the summary statistics in Appendix B while the correlation analysis in Appendix C. From the summary statistics, we notice that (i) the means are comparable and (ii) given the substantial degree of variation, we can be confident that reasonable estimated relationships will emerge. The purpose

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of a correlation matrix is to avoid multicollinearity and over-parameterization issues that could substantially bias estimated coefficients.

3.2. Methodology

We adopt a *two-step* generalised methods moments (GMM) with forward orthogonal deviations instead of differencing as empirical strategy. This strategy is an extension by Roodman (2009a,b) of Arellano and Bover (1995) which has the positive sides of (i) restricting the proliferation of instruments and (ii) controlling for cross-sectional dependence (Love & Zicchino, 2006; Baltagi, 2008). The endogeneity-robust empirical technique is important because as we have seen in the introduction (i) there are inherent issues of endogeneity in the modelling of IA (Ivashina, 2009) and (ii) Triki and Gajigo (2014) have also admitted in the introduction of their paper that they have failed to take it into account.

The following equations in levels (1) and first difference (2) summarise the estimation procedure.

$$FD_{i,t} = \sigma_0 + \sigma_1 FD_{i,t-\tau} + \sigma_2 PCR_{i,t} + \sigma_3 PCB_{i,t} + \sigma_4 Inter_{i,t} + \sum_{j=1}^{5}\sum_{h=1}^{5}\delta_j W_{h,i,t-\tau} + \eta_i + \xi_t + \varepsilon_{i,t} \quad (1)$$

$$\begin{aligned} FD_{i,t} - FD_{i,t-\tau} &= \sigma_0 + \sigma_1(FD_{i,t-\tau} - FD_{i,t-2\tau}) \\ &+ \sigma_2(PCR_{i,t} - PCR_{i,t-\tau}) + \sigma_3(PCB_{i,t} - PCB_{i,t-\tau}) \\ &+ \sigma_4(Inter_{i,t} - Inter_{i,t-\tau}) \\ &+ \sum_{j=1}^{5}\sum_{h=1}^{5}\delta_j(W_{h,i,t-\tau} - W_{h,i,t-2\tau}) \\ &+ (\xi_t - \xi_{t-\tau}) + \varepsilon_{i,t-\tau} \end{aligned} \quad (2)$$

where $FD_{i,t}$ is the financial development (depth, efficiency, activity and size) of country i at period t; α is a constant; τ represents the rate autocorrelation; PCR, public credit registries; PCB, private credit bureaus; *Inter*, interaction among either PCR (PCR × PCR) or PCB (PCB × PCB); W is the vector of five control variables (*inflation*, *public investment*, *GDP growth*, *trade* and *foreign aid*), η_i is the country-specific effect, ξ_t is the time-specific constant and $\varepsilon_{i,t}$ the error term. In the specification, we prefer the *two-step* to the *one-step* procedure because it is heteroscedasticity-consistent. Adoption of the GMM approach presupposes that the number of cross-sections should be higher than the number of time series in cross-sections ($N > T$) and the dependent variables should be persistent. These conditions are fulfilled because on the one hand $53 > 8$ (2004–2011) and on the other hand, the overwhelming persistence of the dependent variables is provided in Appendix D. Consistent with Brambor et al. (2006) on the pitfalls in interactive regressions (i) all constitutive terms are included in the specifications and (ii) the effect of the modifying variables (or ISOs) which should be within range is interpreted in terms of marginal impact.

4. Empirical results

4.1. Presentation of results

In this section we present estimated findings. Tables 1 and 2 show results for financial depth (efficiency) whereas Table 3 reveals those for financial activity and size. We associate three specifications to each of the seven financial variables employed: (i) a baseline specification in which we assess the effects of PCRs and PCBs without interactions, (ii) a second specification with interactive PCRs to assess the marginal effect of increasing PCRs and (iii) a third specification with interactive PCBs to examine the marginal impact of increasing PCBs. It should be noted that, in spite of PCRs being part of PCBs, we enter them simultaneously into the first specification because they do not suffer from issues of multicollinearity since their corresponding correlation coefficient is −0.14 (see Appendix C).

The specifications are tailored to avoid issues of instrument proliferation by ensuring that the number of instruments for each specification is lower than the corresponding number of cross-sections. We consider valid specifications as only those for which post-estimation tests confirm the validity of instruments and absence of autocorrelation in the residuals. First, for the autocorrelation test, the second-order Arellano and Bond (1991) test is preferred to the first-order because the latter is traditionally expected to be significant. Second, in the event of conflict of interest, the Hansen overindentifying restrictions (OIR) test is preferred to the Sargan alternative because it is more robust. We also complement the Hansen test with the difference-in-Hansen test for instrument exogeneity. It should be noted that the Sargan OIR test is not robust and not weakened by many instruments whereas the Hansen OIR test is robust and weakened by many instruments. Therefore, as highlighted earlier, by ensuring that the rule of thumb on instrument proliferation is respected, we also use the Hansen test to assess the exogeneity of instruments.

The left-hand-side (LHS) of Table 1 shows findings for overall economic depth while the right-hand-side (RHS) presents results corresponding to financial system depth. The following findings can be established. First, while PCRs consistently have a negative impact on financial depth, PCBs exert a negative effect exclusively in the baseline regression of money supply. The negative magnitude of PCRs is higher, relative to PCBs. Second, from the interactions, whereas PCR interactions still exert a negative effect on financial system depth, the effect of PCB interactions is positive, albeit not significant. It follows that; PCBs may be more instrumental in increasing financial depth relative to PCRs. Third, but for GDP growth, the significant control variables have the expected signs. Accordingly, as we have justified in the Data section, public investment (Huang, 2011), trade (Do & Levchenko, 2004; Huang & Temple, 2005) and foreign aid have been documented to be associated with higher levels of financial development (Asongu, 2014).

In Table 2 on financial efficiency and IA, specifications on the RHS for financial system efficiency are invalid because they fail to align with the information criterion for the absence of autocorrelation. First, we find that PCBs are significantly and negatively

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Table 1
Financial depth and information asymmetry.

	Financial depth					
	Economic depth (money supply)			Financial system depth (deposits)		
	Baseline	PCRs	PCBs	Baseline	PCRs	PCBs
Constant	**−3.917***	**−7.294*****	−2.509	**−3.838****	**−5.441*****	**−3.534*****
	(0.073)	**(0.001)**	(0.156)	**(0.040)**	**(0.008)**	**(0.009)**
Money supply (−1)	**1.115*****	**1.083*****	**1.003*****	–	–	–
	(0.000)	**(0.000)**	**(0.000)**			
Fin. system deposits (−1)	–	–	–	**1.056*****	**1.099*****	**1.035*****
				(0.000)	**(0.000)**	**(0.000)**
Public credit registries (PCRs)	**−0.236*****	**−0.146****	–	**−0.162*****	**−0.143*****	–
	(0.000)	**(0.022)**		**(0.000)**	**(0.000)**	
Private credit bureaus (PCBs)	**−0.114*****	–	−0.052	−0.023	–	−0.050
	(0.003)		(0.174)	(0.297)		(0.105)
PCRs×PCRs	–	−0.001	–	–	**−0.001****	–
		(0.175)			**(0.033)**	
PCBs×PCBs	–	–	0.0008	–	–	0.001
			(0.180)			(0.102)
GDP growth	**−0.176*****	**−0.182*****	**−0.179*****	**−0.092*****	**−0.094*****	**−0.101*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.001)**	**(0.003)**	**(0.000)**
Inflation	−0.011	−0.008	0.004	−0.004	−0.012	−0.005
	(0.359)	(0.480)	(0.717)	(0.598)	(0.204)	(0.422)
Public investment	−0.038	0.038	−0.043	−0.004	**0.080*****	0.029
	(0.337)	(0.254)	(0.167)	(0.891)	**(0.005)**	(0.310)
Foreign aid	0.020	**0.079***	0.023	**0.083***	**0.088***	**0.075***
	(0.696)	**(0.097)**	(0.661)	**(0.060)**	**(0.073)**	**(0.059)**
Trade	**0.042****	**0.068*****	**0.053*****	**0.047****	**0.042***	**0.037*****
	(0.034)	**(0.001)**	**(0.000)**	**(0.020)**	**(0.055)**	**(0.000)**
AR(1)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
AR(2)	**(0.881)**	**(0.994)**	**(0.350)**	**(0.703)**	**(0.629)**	**(0.349)**
Sargan OIR	(0.004)	(0.002)	(0.052)	(0.005)	(0.012)	(0.003)
Hansen OIR	**(0.253)**	**(0.140)**	**(0.318)**	**(0.293)**	**(0.154)**	**(0.442)**
DHT for instruments						
(a) Instruments in levels						
H excluding group	(0.085)	**(0.162)**	(0.017)	**(0.382)**	**(0.205)**	**(0.112)**
Dif (null, *H* = exogenous)	**(0.565)**	**(0.228)**	**(0.941)**	**(0.284)**	**(0.215)**	**(0.778)**
(b) IV (years, eq (diff))						
H excluding group	**(0.435)**	**(0.234)**	**(0.243)**	**(0.256)**	**(0.317)**	**(0.257)**
Dif (null, *H* = exogenous)	**(0.137)**	**(0.148)**	**(0.536)**	**(0.444)**	**(0.103)**	**(0.799)**
Fisher	**2332.01*****	**2503.26*****	**6921.22*****	**3191.03*****	**15,848.7*****	**11,732.7*****
Instruments	37	37	37	37	37	37
Countries	45	45	45	45	45	45
Observations	258	260	260	258	260	260

DHT: difference in Hansen test for exogeneity of instruments' subsets; Dif: difference; OIR: over-identifying restrictions test; GDP: gross domestic product.
P-values in brackets. The significance of bold values is twofold: (1) the significance of estimated coefficients, and the Fisher statistics and (2) the failure to reject the null hypotheses of: (a) no autocorrelation in the AR(1) and AR(2) tests; and (b) the validity of the instruments in the Sargan OIR test, Hansen OIR test and DHT tests.
* Significance at 10% level.
** Significance at 5% level.
*** Significance at 1% level.

linked to banking system efficiency whereas the effect of PCRs is not significant. Second, the interactions among PCRs and PCBs respectively in specifications 2 and 3 are not significant. Third, the significant control variables have signs that are expected and contrasting with those of Table 1 for reasons already provided in Section 3.1. In essence, financial depth (in Table 1) contrasts with financial allocation efficiency (in Table 2) because it (for the most part) measures financial development in terms of financial deposits (or liquid liabilities), whereas financial allocation efficiency is the degree by which such deposits are transformed into credits (or financial activity).

We discuss the results presented in Table 3 in two ways, namely in terms of: financial activity and financial size. First, as regards the findings of financial activity, the following can be established. (1) Both PCR and PCB have negative effects on financial activity, with the negative magnitude of the latter higher on the dependent variable. (2) Increasing PCRs and PCBs with interaction effects does not change the negative signs because

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Table 2
Financial efficiency and information asymmetry.

	Financial efficiency					
	Banking system efficiency (BcBd)			Financial system efficiency (FcFd)		
	Baseline	PCR	PCB	Baseline	PCR	PCB
Constant	**28.790*****	**24.414*****	**20.267*****	**19.323*****	**11.381*****	**12.379*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.004)**	**(0.001)**
Banking system efficiency (−1)	**0.767*****	**0.761*****	**0.812*****	–	–	–
	(0.000)	**(0.000)**	**(0.000)**			
Financial system efficiency (−1)	–	–	–	**0.882*****	**0.818*****	**0.827*****
				(0.000)	**(0.000)**	**(0.000)**
Public credit registries (PCR)	0.148	−0.117	–	−0.087	−0.160	–
	(0.184)	(0.618)		(0.212)	(0.146)	
Private credit bureaus (PCB)	**−0.191****	–	−0.058	**−0.443*****	–	0.008
	(0.029)		(0.691)	**(0.000)**		(0.928)
PCR×PCR	–	0.004	–	–	**0.004***	–
		(0.314)			**(0.051)**	
PCB×PCB	–	–	−0.0007	–	–	**−0.005*****
			(0.767)			**(0.000)**
GDP growth	**0.552*****	**0.560*****	**0.452*****	**0.580*****	**0.612*****	**0.569*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Inflation	**0.0006*****	**0.0006*****	**0.0006*****	−0.013	0.099	0.031
	(0.000)	**(0.000)**	**(0.000)**	(0.878)	(0.163)	(0.706)
Public investment	**−0.405*****	**−0.301****	−0.343	**−0.175***	−0.096	−0.140
	(0.002)	**(0.037)**	(0.003)	**(0.089)**	(0.224)	(0.137)
Foreign aid	**−0.612*****	**−0.399*****	**−0.273****	**−0.478*****	**−0.220*****	**−0.211****
	(0.000)	**(0.004)**	**(0.031)**	**(0.000)**	**(0.004)**	**(0.017)**
Trade	**−0.058****	−0.015	0.004	−0.030	0.041	0.042
	(0.035)	(0.661)	(0.874)	(0.392)	(0.219)	(0.295)
AR(1)	(0.002)	(0.002)	(0.002)	(0.047)	**(0.142)**	(0.029)
AR(2)	**(0.120)**	**(0.123)**	**(0.138)**	(0.017)	(0.020)	(0.014)
Sargan OIR	**(0.209)**	**(0.369)**	**(0.107)**	(0.013)	(0.000)	(0.003)
Hansen OIR	**(0.598)**	**(0.503)**	**(0.421)**	**(0.515)**	**(0.168)**	**(0.221)**
DHT for instruments						
(a) Instruments in levels						
H excluding group	**(0.753)**	**(0.554)**	**(0.564)**	**(0.381)**	**(0.258)**	**(0.201)**
Dif (null, *H* = exogenous)	**(0.414)**	**(0.422)**	**(0.326**	**(0.555)**	**(0.201)**	**(0.321)**
(b) IV (years, eq(diff))						
H excluding group	**(0.676)**	**(0.525)**	**(0.325)**	**(0.406)**	**(0.390)**	**(0.473)**
Dif (null, *H* = exogenous)	**(0.340)**	**(0.391)**	**(0.583)**	**(0.622)**	**(0.080)**	**(0.087)**
Fisher	**519.23*****	**1410.72*****	**4035.65*****	**152.46*****	**700.86*****	**337.49*****
Instruments	37	37	37	37	37	37
Countries	45	45	45	45	45	45
Observations	265	267	267	258	260	260

DHT: difference in Hansen test for exogeneity of instruments' subsets; Dif: difference; OIR: over-identifying restrictions test; GDP: gross domestic product.
P-values in brackets. The significance of bold values is twofold: (1) the significance of estimated coefficients and the Fisher statistics and (2) the failure to reject the null hypotheses of: (a) no autocorrelation in the AR(1) and AR(2) tests; and (b) the validity of the instruments in the Sargan OIR test, Hansen OIR test and DHT tests.
* Significance at 10% level.
** Significance at 5% level.
*** Significance at 1% level.

the marginal effects are still negative. (3) The significant control variables have the expected signs.

Second, on the relationships with financial size, the following findings are apparent. (1) Both PCR and PCB have positive effects on the dependent variable, with the impact of the former higher and (2) Increasing PCRs and PCBs beyond certain thresholds lead to significant marginal effects but unfortunately, the modifying thresholds are not within range, notably: 57.57 (0.403/0.007) for PCR and 102.5 (0.205/0.002) for PCB. Accordingly, the corresponding ranges provided by the summary statistics in Appendix B are respectively '0–49.8′ and '0–64.8′. (3) The significant control variables have the expected signs.

4.2. Further discussion and policy implications

We engage this section in four main strands, namely discussion on: (i) general findings in relation to surplus liquidity

Table 3
Financial activity, financial size and information asymmetry.

	Financial activity								
	Banking system activity (Pcrb)			Financial system activity (Pcrbof)			Financial size		
	Baseline	PCR	PCB	Baseline	PCR	PCB	Baseline	PCR	PCB
Constant	−1.024	**−2.411***	**−3.196*****	1.266	−0.027	**−3.246*****	**20.078*****	**21.699*****	**19.688*****
	(0.551)	**(0.087)**	**(0.001)**	(0.468)	(0.987)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Banking sys. activity (−1)	**1.173*****	**1.143*****	**1.038*****	–	–	–	–	–	–
	(0.000)	**(0.000)**	**(0.000)**						
Financial sys. activity (−1)	–	–	–	**1.150*****	**1.125*****	**1.058*****	–	–	–
				(0.000)	**(0.000)**	**(0.000)**			
Financial size (−1)	–	–	–	–	–	–	**0.699*****	**0.675*****	**0.734*****
							(0.000)	**(0.000)**	**(0.000)**
Public credit registries (PCR)	**−0.171*****	−0.068	–	**−0.120*****	**−0.054***	–	**0.134****	**0.403*****	–
	(0.000)	(0.166)		**(0.000)**	**(0.097)**		**(0.011)**	**(0.000)**	
Private credit bureaus (PCB)	**−0.096*****	–	−0.003	**−0.086*****	–	**0.048***	**0.057****	–	**0.205*****
	(0.000)		(0.921)	**(0.000)**		**(0.076)**	**(0.032)**		**(0.000)**
PCR×PCR	–	**−0.001****	–	–	**−0.0008***	–	–	**−0.007*****	–
		(0.020)			**(0.075)**			**(0.000)**	
PCB×PCB	–	–	−0.0004	–	–	**−0.001*****	–	–	**−0.002*****
			(0.307)			**(0.001)**			**(0.000)**
GDP growth	0.035	0.049	0.024	−0.013	0.020	0.016	0.047	−0.024	−0.018
	(0.267)	(0.147)	(0.414)	(0.733)	(0.634)	(0.615)	(0.323)	(0.575)	(0.752)
Inflation	−0.022	−0.016	−0.013	−0.036	−0.022	**−0.019*****	**−0.107*****	**−0.100****	**−0.101****
	(0.344)	(0.347)	(0.335)	(0.161)	(0.293)	**(0.034)**	**(0.009)**	**(0.019)**	**(0.031)**
Public investment	**0.179*****	**0.168*****	**0.053***	**0.156*****	**0.145*****	**0.069****	**0.134***	**0.141****	**0.225*****
	(0.000)	**(0.000)**	**(0.071)**	**(0.000)**	**(0.000)**	**(0.010)**	**(0.080)**	**(0.037)**	**(0.001)**
Foreign aid	0.010	−0.019	**0.048****	−0.045	−0.052	**0.044****	−0.018	0.082	0.001
	(0.811)	(0.596)	**(0.012)**	(0.351)	(0.201)	**(0.048)**	(0.828)	(0.306)	(0.988)
Trade	−0.023	−0.008	**0.031*****	**−0.040****	**−0.027***	**0.023***	**0.063*****	**0.058****	0.020
	(0.218)	(0.607)	**(0.008)**	**(0.025)**	**(0.088)**	**(0.062)**	**(0.007)**	**(0.023)**	(0.372)
AR(1)	(0.043)	(0.036)	(0.013)	**(0.115)**	(0.085)	(0.023)	(0.076)	(0.069)	(0.060)
AR(2)	**(0.389)**	**(0.229)**	**(0.232)**	**(0.178)**	(0.097)	**(0.113)**	**(0.716)**	**(0.706)**	**(0.515)**
Sargan OIR	**(0.170)**	**(0.058)**	(0.000)	(0.008)	(0.010)	(0.000)	**(0.603)**	**(0.598)**	**(0.768)**
Hansen OIR	**(0.261)**	**(0.494)**	**(0.395)**	**(0.292)**	**(0.367)**	**(0.254)**	**(0.633)**	**(0.730)**	**(0.782)**
DHT for instruments									
(a) Instruments in levels									
H excluding group	**(0.327)**	**(0.257)**	**(0.467)**	**(0.260)**	**(0.394)**	**(0.433)**	**(0.726)**	**(0.426)**	**(0.354)**
Dif (null, *H* = exogenous)	**(0.277)**	**(0.641)**	**(0.351)**	**(0.368)**	**(0.363)**	**(0.215)**	**(0.471)**	**(0.783)**	**(0.883)**
(b) IV (years, eq (diff))									
H excluding group	**(0.535)**	**(0.614)**	**(0.549)**	**(0.435)**	**(0.320)**	**(0.301)**	**(0.665)**	**(0.727)**	**(0.872)**
Dif (null, *H* = exogenous)	(0.090)	**(0.265)**	**(0.208)**	**(0.182)**	**(0.473)**	**(0.274)**	**(0.414)**	**(0.499)**	**(0.344)**
Fisher	**3115.95*****	**20,933.4*****	**5309.26*****	**3495.71*****	**12,445.2*****	**15,962.7*****	**379.52*****	**853.78** ***	**970.06*****
Instruments	37	37	37	37	37	37	37	37	37
Countries	45	45	45	45	45	45	45	45	45
Observations	258	260	260	260	262	262	260	262	262

DHT: difference in Hansen test for exogeneity of instruments' subsets; Dif: difference; OIR: over-identifying restrictions test; GDP: gross domestic product.
P-values in brackets. The significance of bold values is twofold: (1) the significance of estimated coefficients and the Fisher statistics and (2) the failure to reject the null hypotheses of: (a) no autocorrelation in the AR(1) and AR(2) tests; and (b) the validity of the instruments in the Sargan OIR test, Hansen OIR test and DHT tests.

* Significance at 10% level.
** Significance at 5% level.
*** Significance at 1% level.

issues in African financial institutions, (ii) specific findings and their relation with existing literature, (iii) quiet of life hypothesis (QLH) and the role of information sharing offices (ISOs); (iv) relations to moral hazard on the part borrowers and disciplinary effect from ISOs and (v) how ISOs can be tailored towards addressing concerns of excess liquidity.

First, the concern about surplus liquidity in African financial institutions has been broadly confirmed from the findings. Accordingly, the inability of banks to increase allocation efficiency and financial activity with the help of ISOs may imply that the use of PCR and PCB as means to addressing investment needs (through the fight against surplus liquidity) have not yielded the expected outcomes. It is relevant to recall that the underlying issues of excess cash within formal banking establishments (Saxegaard, 2006; Fouda, 2009) represent one of the most important challenges in African business literature (Bartels

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et al., 2009; Tuomi, 2011; Kolstad & Wiig, 2011; Darley, 2012). As a policy implication, in addition to improving the current structure and relevance of ISOs, other measures could be tailored towards fighting surplus liquidity issues, notably on (i) voluntary holding of surplus liquidity (easing issues associated with interbank lending, facilitating banks to track their positions at central banks, inter alia) and (ii) involuntary holding of surplus liquidity (developing regional stock markets for more investment opportunities by banks, creating an enabling environment that facilitates spreads between bonds and reserves, among others).

Second, it is important to also discuss our findings in the light of the existing literature engaged analytically in the introduction. Accordingly, our findings could be summarised as the following. (1) PCR and PCB have negative effects on financial depth, with the magnitude of the former higher. (2) Contrary to PCR which have insignificant effects, PCB has a negative impact on banking system efficiency. (3) PCR and PCB have negative effects on financial activity, with the magnitude of the latter higher. Moreover, marginal effects for both are negative. (4) Both PCR and PCB have positive effects on financial size, with the effect of the former higher. While marginal effects are positive, corresponding thresholds are not within range.

The above findings substantially run counter to Singh et al. (2009) who have established that countries in Sub-Saharan Africa that encourage the sharing of credit information are more likely to be rewarded with higher levels of credit to the private sector as a share of GDP. This measure of financial development has been termed 'financial activity' in this line of inquiry. The position by Galindo and Miller (2001) that countries with more advanced development in credit registries are rewarded with less financial restrictions relative to those with credit bureaus that are less developed, can only be confirmed in our findings from the perspective of financial size. In the same vein, the findings of Love and Mylenko (2003) are also only partially confirmed. According to the authors, the presence of private registries is linked to a higher share of bank financing and lower financing constraints, whereas the presence of public registries do not appear to exert any significant impact on underlying financing constraints. It is important to note that the findings of Galindo and Miller (2001) and Love and Mylenko (2003) are based on different datasets. We are using a dataset that was collected after their studies were published. The findings of Singh et al. (2009) are also based on data for average five-year intervals for the period 1992–2006. This implies that just half of the last periodic interval (2001–2006) is considered in our dataset. Hence, differences with prior literature could be traceable to differences in periodicities and proxies for ISOs.

We compare our findings with those of Triki and Gajigo (2014) in more depth because as far as we have reviewed, it is the study in the literature closest to the current line of inquiry. They have concluded that access to finance is on average higher in countries with PCBs relative to those with PCRs or neither institution. Our results confirm and reject the underlying conclusion. First, on the rejection front, the following inferences are apparent. (1) The results on financial efficiency are broadly inconsistent in the view that contrary to PCRs which have insignificant consequences, PCBs exert a negative effect on banking system efficiency. Hence, it follows that PCBs are more detrimental than PCRs when it comes to facilitating access to finance. But it should be noted that this rejection is only partial because we are comparing 'significant positive effects' from the underlying study with 'insignificant and negative' impacts. (2) With regard to financial size, we have established that while PCBs and PCRs exert positive effects on financial size, the impact of the latter is higher, which is contrary to the findings of the underlying study which established that the impact of the former is higher instead. Second, on the confirmation front, the following can be observed. (1) From the findings on financial depth, there is (i) a confirmation if the comparison is exclusively based on magnitude of estimated coefficients and (ii) a rejection if we are dealing with the signs of estimated coefficients. (2) The discussion in (1) is also relevant to the findings on financial efficiency.

The above comparative evidence also implies that the role of ISOs on financial access in Africa is still open to much debate. Meanwhile, variations in findings could be traceable to differences in indicators (or choice of financial development variables), periodicity (use of an updated sample) and methodology (endogeneity-robust), which we have already outlined in Section 1.

The third strand discusses corresponding concerns about the 'quite of life hypothesis' (QLH)[3] enjoyed by financial institutions and the role of ISOs (PCRs and PCRs). Accordingly, in light of the findings, we might be tempted to infer that instead of improving financial access, African financial institutions are taking advantage of information provided by ISOs to increase their profit margins. As to what concerns the role of an ISO, we may also be tempted to infer that these are not fulfilling their missions as theoretically expected. This is essentially because ISOs are expected to reduce informational rents associated with high cost of credit (financial activity). Given that (i) 'quite of life' is enjoyed by big banks with substantial market power and (ii) ISOs are relevant to controlling the abuse of market power, we may also be tempted to infer that banking competition is not very intense. Hence, the role of ISOs in financial development in SSA may not be having the desired effects because they have not outweighed the power of big banks by, inter alia rendering credit markets contestable, sharing information to enhance competition and reducing informational rents (Pagano & Jappelli, 1993, p. 2019). Hence, policy could use other measures to among others: (i) limit the financial market power of a few banks and (ii) enhance a competitive financial environment.

This leads us to the fourth strand, which discusses the possible relationship between the findings of this paper, moral hazard (on the part of customers) and ISOs as a disciplinary device for borrowers. The intuition here is that information sharing by PCRs and PCBs may not be yielding the desired outcomes

[3] The QLH is a postulation that, financial institutions with higher market power would invest less in pursuing intermediation efficiency: instead of tailoring the advantage of their favourable position to granting more loans to borrowers at affordable prices, they would prefer to 'exploit their market power' for more gains or enjoy a 'quiter life' (Coccorese & Pellecchia, 2010).

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in financial development because of continuous moral hazard issues from borrowers. Accordingly, even when banks have lost all potential informational rents from the activities of ISOs, they may still not be willing to lend if they are not motivated by a higher repayment probability. This is essentially because, ISOs also play the role of a 'discipline device' for borrowers by providing incentives to perform and reduce moral hazard. In this light, a policy implication may be tailored with the assumption that, ISOs are not effective at disciplining borrowers to reduce their moral hazard because of a plethora of reasons, among others: borrowers are not afraid to lose their reputation, corruption in lending may be rampant and recourse to financing mechanisms from the informal financial sector could be a genuine and reliable alternative.

In the fifth strand, ISOs can leverage on growing synchronisation of information through the 'knowledge economy' and 'information and communication technologies"-oriented human resources in order to address concerns deeply entrenched in involuntary and voluntary keeping of excess liquidity by banks. First, with regard to the voluntary keeping of excess cash, the suggested orientations would strengthen the capability of ISOs to: (i) ease interbank lending, especially for contingency purposes, (ii) overcome concerns about transportation which constrain bank branches in enclaved zones in keeping excess reserves and (iii) avoid the keeping of reserves beyond statutory limits by reducing difficulties that banks encounter when it comes to updating their positions in central banks.

Second, ISOs can also leverage on the underlying 'knowledge economy' and 'information and communication technology' instruments in order to limit the involuntary holding of surplus liquidity by: (i) enhancing competition in lending between financial institutions, (ii) easing the possibility of financial institutions to invest in bond markets, (iii) enlarging opportunities of investment in regional stock markets by banks and (iv) reducing the inability of banks to lend when interest rates are regulated. To be more effective, the engaged instruments should be characterised with the following: (i) high-speed access to the internet that is reliable, (ii) 'state of the art' systems of information mechanisms in ISOs and banks and (iii) regular training of staff in ISOs as well as leveraging on mobile banking.

5. Conclusion and future research directions

We have examined policy thresholds of information sharing for financial development in 53 African countries for the period 2004–2011. Public credit registries (PCRs) and private credit bureaus (PCBs) are used as proxies for reducing information asymmetry whereas financial development is measured in terms of depth, efficiency, activity and size. The empirical evidence is based on interactive generalised methods of moments with forward orthogonal deviations. The following findings have been established. First, PCRs and PCBs have negative effects on financial depth, with the magnitude of the former higher. Second, contrary to PCRs which have insignificant effects, PCBs have a negative impact on banking system efficiency. Third, PCRs and PCBs have negative effects on financial activity, with the magnitude of the latter higher. Moreover, marginal effects for both are negative. Fourth, PCRs and PCBs have positive effects on financial size, with the effect of the former higher. While marginal effects are positive, corresponding thresholds are not within range.

The above findings have shown that, with the exception of financial size, the introduction of information sharing offices in Africa as a policy of increasing financial access have instead, for the most part led to the opposite effects. We have also investigated whether increasing the number of underlying registries/bureaus would result in the expected effects. Unfortunately, we are tempted to infer that reducing information asymmetry is not enhancing financial allocation efficiency and facilitating the availability of credit. This naturally leaves enough room for future research, notably in (i) more in-depth analysis on the relevance of information sharing offices and (ii) mechanisms by which their missions could be fulfilled. Moreover, assessing the relevance of information sharing offices throughout the conditional distributions of the financial dynamics could also yield interesting policy directions.

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Appendix A. Variable definitions

Variables	Signs	Variable definitions	Sources
Economic financial depth	M2	Money supply (% of GDP)	World Bank (FDSD)
Financial system depth	Fdgdp	Liquid liabilities (% of GDP)	World Bank (FDSD)
Banking system efficiency	BcBd	Bank credit on bank deposits	World Bank (FDSD)
Financial system efficiency	FcFd	Financial credit on financial deposits	World Bank (FDSD)
Banking system activity	Prcb	Private domestic credit from deposit banks (% of GDP)	World Bank (FDSD)
Financial system activity	Prcbof	Private domestic credit from financial institutions (% of GDP)	World Bank (FDSD)
Financial size	Dbacba	Deposit bank assets on central bank assets plus deposit bank assets	World Bank (FDSD)
Information asymmetry	PCR	Public credit registry coverage (% of adults)	World Bank (WDI)
	PCB	Private credit bureau coverage (% of adults)	World Bank (WDI)
Economic prosperity	GDPg	GDP growth (annual %)	World Bank (WDI)
Inflation	Infl	Consumer price index (annual %)	World Bank (WDI)
Public investment	PubIvt	Gross public investment (% of GDP)	World Bank (WDI)
Development assistance	NODA	Total net official development assistance (% of GDP)	World Bank (WDI)
Trade openness	Trade	Imports plus exports in commodities (% of GDP)	World Bank (WDI)

WDI: World Bank development indicators; FDSD: financial development and structure database.

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Appendix B. Summary statistics (2004–2011)

	Variables	Mean	SD	Min	Max	Observations
Financial development	Economic financial depth (M2)	34.279	22.294	6.363	112.83	377
	Financial system depth (Fdgdp)	28.262	21.066	2.926	92.325	377
	Banking system efficiency (BcBd)	68.118	27.725	14.804	171.85	402
	Financial system efficiency (FcFd)	68.118	27.725	14.804	171.85	402
	Banking system activity (Pcrb)	72.722	35.884	22.200	252.88	377
	Financial system activity (Pcrbof)	21.571	24.154	0.010	149.77	379
	Financial size (Dbacba)	78.073	20.255	4.032	99.949	399
Information asymmetry	Public credit registries (PCR)	2.155	5.812	0	49.8	381
	Private credit bureaus (PCB)	4.223	13.734	0	64.8	380
Control variables	Economic prosperity (GDPg)	4.996	4.556	−17.66	37.998	404
	Inflation	7.801	4.720	0	43.011	357
	Public investment	74.778	1241.70	−8.974	24,411	387
	Development assistance	10.396	12.958	0.027	147.05	411
	Trade openness (trade)	80.861	32.935	24.968	186.15	392

SD: standard deviation; Min: minimum; Max: maximum; M2: money supply; Fdgdp: financial deposits (liquid liabilities); BcBd: bank credit on bank deposits; FcFd: financial credit on financial deposits; Pcrb: private domestic credit from deposit banks; Pcrbof: private domestic credit from deposit banks and other financial institutions; Dbacba: deposit bank assets on central bank assets plus deposit bank assets; GDPg: GDP growth.

Appendix C. Correlation analysis (uniform sample size: 291)

Financial development dynamics							Info. asymmetry		Other variables					
Financial depth		Financial efficiency		Financial activity		Fin. size	PCR	PCB	GDPg	Inflation	PubIvt	NODA	Trade	
M2	Fdgdp	BcBd	FcFd	Prcb	Pcrbof	Dbacba								
1.000	0.970	0.094	0.103	0.821	0.629	0.398	0.416	0.147	−0.104	−0.080	0.055	−0.295	0.140	M2
	1.000	0.130	0.220	0.886	0.754	0.452	0.409	0.303	−0.091	−0.063	0.070	−0.320	0.149	Fdgdp
		1.000	0.859	0.490	0.495	0.243	0.154	0.303	−0.016	−0.144	−0.169	−0.133	−0.176	Bcbd
			1.000	0.583	0.743	0.242	0.067	0.510	−0.056	−0.097	−0.149	−0.179	−0.189	FcFd
				1.000	0.922	0.478	0.448	0.439	−0.092	−0.089	−0.055	−0.343	0.093	Pcrb
					1.000	0.413	0.293	0.556	−0.088	−0.073	−0.057	−0.324	0.019	Pcrbof
						1.000	0.249	0.343	−0.061	−0.142	0.198	−0.403	0.210	Dbacba
							1.000	−0.140	−0.026	−0.081	0.068	−0.154	0.207	PCR
								1.000	−0.101	−0.035	−0.047	−0.329	0.084	PCB
									1.000	−0.169	0.129	0.122	0.037	GDPg
										1.000	−0.081	−0.0004	−0.006	Inflation
											1.000	0.059	0.130	PubIvt
												1.000	−0.309	NODA
													1.000	Trade

M2: money supply; Fdgdp: financial deposits (liquid liabilities); BcBd: bank credit on bank deposits; FcFd: financial credit on financial deposits; Pcrb: private domestic credit from deposit banks; Pcrbof: private domestic credit from deposit banks and other financial institutions; Dbacba: deposit bank assets on central bank assets plus deposit bank assets; Info: information; PCR: public credit registries; PCB: private credit bureaus; GDPg: GDP growth; Popg: population growth; PubIvt: public investment; NODA: net official development assistance; Info: information.

Appendix D. Persistence of the dependent variables

	Financial depth		Financial efficiency		Financial activity		Fin. size
	M2	Fdgdp	BcBd	FcFd	Pcrd	Pcrdof	Dbacba
M2 (−1)	0.9837						
Fdgdp (−1)		0.990					
BcBd (−1)			0.9438				
FcFd (−1)				0.9815			
Pcrd (−1)					0.9919		
Pcrdof (−1)						0.9945	
Dbacba (−1)							0.9330

M2: money supply; Fdgdp: financial deposits (liquid liabilities); BcBd: bank credit on bank deposits; FcFd: financial credit on financial deposits; Pcrb: private domestic credit from deposit banks; Pcrbof: private domestic credit from deposit banks and other financial institutions; Dbacba: deposit bank assets on central bank assets plus deposit bank assets; M2 (−1): lagged value of money supply; Fin: financial.

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